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Redescription of *Centropages ponticus* Karavaev, 1895 (Copepoda: Calanoida) from the Black Sea

Переописание *Centropages ponticus* Karavaev, 1895 (Copepoda: Calanoida) из Черного моря

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KEY WORDS: *Centropages ponticus*, Calanoida, Copepoda, redescription, Black Sea, Mediterranean Sea.

КЛЮЧЕВЫЕ СЛОВА: *Centropages ponticus*, Calanoida, Copepoda, переописание, Черное море, Средиземное море.

ABSTRACT. *Centropages ponticus* Karavaev, 1895 is an endemic to the Mediterranean basin and one of the common species of copepods in the coastal waters of the region. However, its first description is very short and incomplete, and as a consequence, some uncertainty in the issue of correct identification of this species still remains. In the present work, a complete illustrated description of *C. ponticus* from the Sevastopol Bay (Black Sea), a type locality of this species, is performed. Based on a comparative analysis of five species of the *hamatus* group of the genus *Centropages* including *C. ponticus*, a differential diagnosis of the latter is given. Differences in the morphological structure of *C. ponticus* from the Black (own data) and Mediterranean (literature data) seas are described.

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РЕЗЮМЕ. *Centropages ponticus* Karavaev, 1895 — эндемик Средиземноморского бассейна и один из обычных массовых видов копепод в прибрежных акваториях данного региона. Однако первое описание этого вида очень короткое и неполное, вследствие чего имеются трудности при его идентификации. В настоящей работе выполнено полное иллюстрированное описание *C. ponticus* из Севастопольской бухты (Черное море), типового местообитания этого вида. На основе сравнительного анализа пяти видов группы *hamatus* рода *Centropages*, куда входит и *C. ponticus*, дан его дифференциальный диагноз. Охарактеризованы различия в морфологическом строении *C. ponticus* из Черного (собственные данные) и Средиземного (литературные данные) морей.

Introduction

Centropages ponticus Karavaev, 1895 is one of the common and abundant copepod species in the coastal areas of the Mediterranean basin [Greze *et al*., 1971; Gubanova *et al*., 2014; Papantoniou *et al*., 2015; Siokou-Frangou *et al*., 2004; Soler *et al*., 1988; Ustun *et al*., 2018; and others]. This species was originally described by V. Karavaev [1895], who, studying the Black Sea copepods, revealed differences in the structure of the male fifth leg between the local *Centropages* and *C. kroyeri* Giesbrecht, 1893 (the species described two years earlier from the Mediterranean Sea), and recorded the Black Sea individuals as *Centropages kroyeri* var. *pontica*. Three decades later, Gurney [1927] found in the Suez Canal one male specimen identical to that described by Karavaev, and asserted the morphological differences between C. *kroyeri* var. *pontica* and *C. kroyeri* to be significant enough to regard this variety as a separate species, *C. ponticus* Karavaev, 1895. Later on, Kovalev [1967] conducted a comparative morphological analysis of *C. ponticus* and *C. kroyeri* based on the material collected in the Mediterranean Sea at the stations where both these species were present in plankton. This author reported *C. ponticus* to be occurring abundantly at the North African coast and in the Adriatic Sea along with *C. kroyeri*, as well as he described in detail morphological differences between these two species in males and also in females, and confirmed the conclusion made by Gurney [1927] concerning specific level of *C. ponticus* [Kovalev, 1967]. Karavaev [1895] noted that he had found *C. kroyeri* var. *pontica* in Sevastopol Bay and in the southeastern part of the Black Sea, so these localities can be considered as the type ones for this species.

To date, *C. ponticus* has been recorded for the Mediterranean basin only [Kovalev, 1967; Matishov *et al*., 2015; Razouls *et al*., 2005–2019]. *C. ponticus* is

reported to be an opportunistic and euryhaline species [Soler *et al*., 1988, and references therein] exhibiting variability in size related to environmental changes [Kovalev, 1967; Soler *et al*., 1988]. Morphological variability of *C. ponticus* and resulting difficulty in the correct identification of this species were also repeatedly noted [Garcia-Rodriguez, 1985; Soler *et al*., 1988; Kršinić, 2017]. Karavaev's [1895] description of *C. ponticus*, unfortunately, is short and incomplete with only body, rostrum and fifth legs of the female, and fourth and fifth legs of the male figured and described. The lack of detailed descriptions and drawings of *C. ponticus* caused the need to revise morphology of this species, and at least in two studies, re-descriptions have been made: on the basis of specimens from the Cullera Bay, western Mediterranean [Soler *et al*., 1988], and from the saline lake Mir, eastern Adriatic [Kršinić, 2017].

To our knowledge, no morphological analysis resulting in a detailed characterization and re-description of *C. ponticus* from the Black Sea was carried out, thus, some uncertainty in the issue of a correct identification of this species still remains.

Our objective was to re-describe and illustrate, in detail, the female and male of *Centropages ponticus* Karavaev 1895 from the samples collected in Sevastopol Bay, the place of this species type locality.

Material and methods

The examined specimens were sorted from formaldehyde preserved samples collected with a Juday net (0.1 m^2 mouth area and 150 μ mesh size) in Sevastopol Bay (44.621700º N, 33.549950º E) on August 29, 2013, in the layer 0–10 m at a sea surface temperature 25º C. Entire specimens and dissected parts were mounted in a 50:50 solution of glycerine and distilled water. Measurements were made with the use of a LOMO MBR-9 stereomicroscope. The length of the whole body (TL) was measured laterally from the tip of cephalosome to the posterior margin of the caudal ramus (excluding setae). All line drawings were made using a *camera lucida* on a Leica DM LS2 compound microscope and 'inked' digitally [Coleman, 2003]. Voucher specimens of *C. ponticus* (10 females and 10 males) are deposited in the collection of the Institute of Marine Biological Research of RAS, Sevastopol, Russia. The system of morphological nomenclature is based on that of Huys & Boxshall [1991]. Articulating segments of the antennules and mouthparts are designated by Arabic numerals, ancestral segments and setae by Roman numerals. One seta and one aesthetasc on a segment of the antennule are designated: 1s + 1a. Setal formulae are given in sequence from proximal to distal.

The following abbreviations are used in the tables: CR — caudal rami; Enp — endopod; EnpI–III — endopod ancestral segments 1–3; Exp — exopod; ExpI–III — exopod ancestral segments 1–3; Gns — genital somite; P1–5 — swimming legs 1–5; Pd5 — pedigerous somite 5; Pr — prosome; TL — total body length; Ur — urosome; n/d — no data.

Taxonomy

Order CALANIDAE Dana, 1846
Genus *Centropages* Krøyer, 1849

Centropages ponticus Karavaev, 1895
Figs 1–7.

Centropages krøyeri var. *pontica* Karavaev, 1895, Table I, figs 16–19, Table II, fig. 1.

Centropages krøyeri: Razouls, 1972, fig. 47, B.

Female. Total length 1.07–1.22 mm (mean 1.15 mm, n = 34). Body robust, prosome about 2.5 times as long as urosome. Cephalosome and first pedigerous somite, fourth and fifth pedigerous somites separate; the latter symmetrical with two conspicuous, caudally produced posterolateral projections (Figs 1a, 7a). Rostrum extends into two long, thin filaments directed postero-ventrally. Urosome of three free somites. Genital double-somite is the biggest, asymmetrical in dorsal view, widest at its posterior one-half, swollen more conspicuously on the right, with both left and right lateral swellings covered with small spinules (Figs 1f–i, 7a), dorsal surface of the somite flat, without spinules (Fig. 7b); genital area postero-ventral, genital operculum large, located ventrolaterally on left side occupying about 1/3 of the widest width of genital double-somite, triangular in shape and with a slightly curved distal margin (Fig. 1i); left ventrolateral edge of genital double-somite with a rounded protrusion (arrowed in Fig. 1g,i) better noticeable when genital operculum adjoins the somite not tightly. Caudal rami symmetrical, slightly dilated posteriorly, approximately three times as long as wide, with six terminal setae and small setules in the inner border; ancestral seta I absent, seta VII inserted immediately anterior to seta VI; seta V longest being approximately as long as urosome including caudal rami, seta VII shortest (Fig. 1a,f).

Antennule (Fig. 1b,d,e): symmetrical, extending to a posterior border of caudal rami, of 24 articulated segments; ancestral segments II–IV completely fused; armature as follows: I–2s + 1a, II–IV–3s + 1a, V–1s + 1a, VI–2s + 1a, VII–2s + 1a, VIII–1s + 1a, IX–2s+ 1a, X–2s + 1a (distalmost seta modified – short and curved), XI to XXI–2s + 1a, XXII–1s, XXIII–1s, XXIV–1s + 1s, XXV–1s + 1s, XXVI–XXVIII–5s + 1a.

Antenna (Fig. 2a): coxa with one long inner seta; basis with two long inner setae; endopod two-segmented: segment 1 with two inner setae, segment 2 bilobed with nine and seven setae on proximal and distal lobes, respectively, distal lobe armed with row of spinules; exopod with ancestral segments I–II and III–IV fused, fusion line between segments III and IV visible; ancestral segments I–VIII each with long plumose seta, terminal segments IX–X with 1 + 3 setae.

Mandible (Fig. 2b,c): gnathobase with eight teeth and one seta, third and fourth teeth with small spinules at their base; mandibular palp basis with four setae; endopod two-segmented with four and nine setae, respectively; exopod five-segmented with 1, 1, 1, 1, 2 setae.

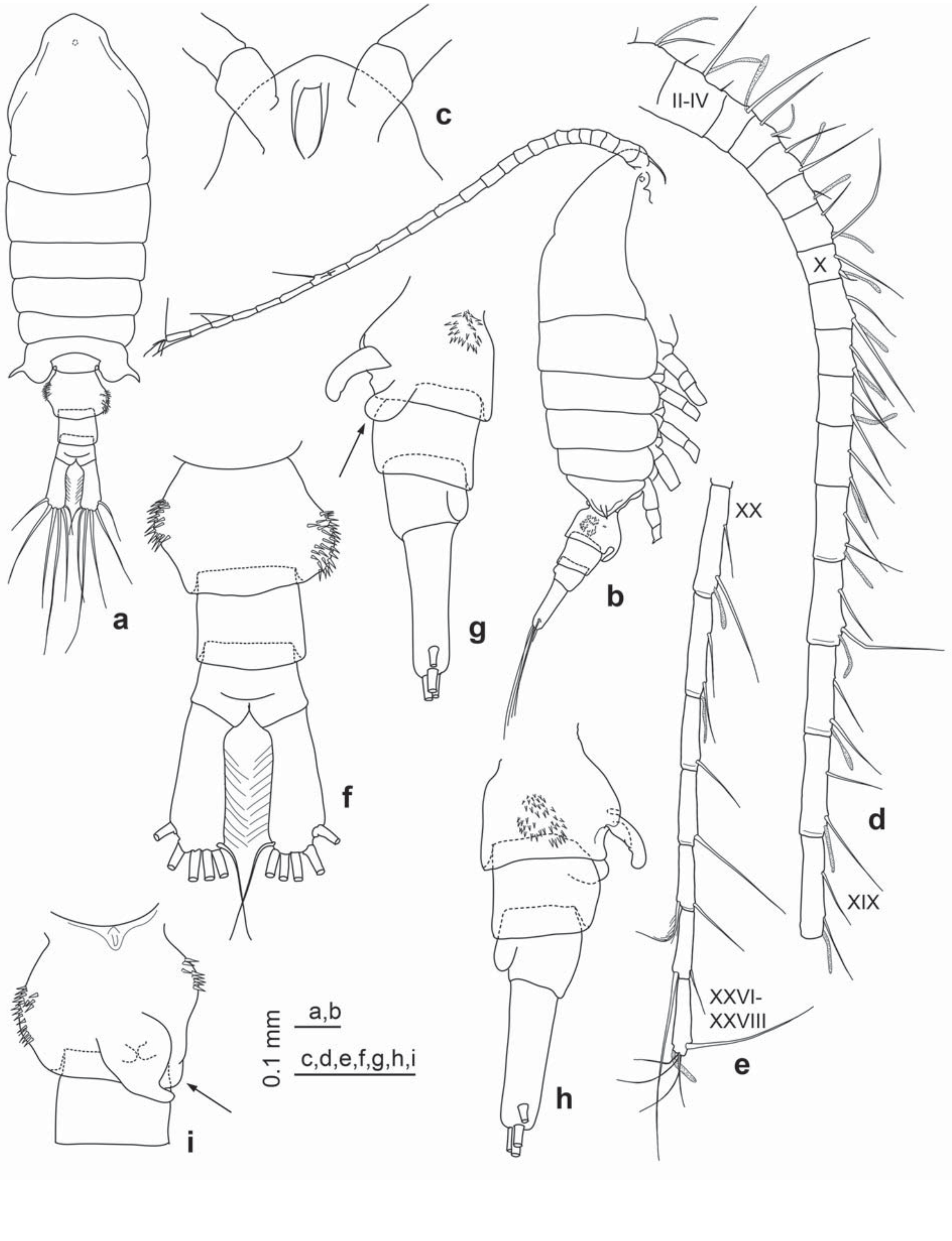


Fig. 1. *Centropages ponticus* female: a — dorsal view; b — lateral view; c — anterior head, ventral view; d — antennule, segments I–XIX; e — antennule, segments XX–XXVIII; f — urosome, dorsal view; g — urosome, left lateral view; h — urosome, right lateral view; i — genital double-somite, ventral view.

Рис. 1. *Centropages ponticus*, самка: a — вид со спинной стороны; b — вид сбоку; c — верхняя часть головы, вид с брюшной стороны; d — антеннула, членики I–XIX; e — антеннула, членики XX–XXVIII; f — уросома, вид со спинной стороны; g — уросома, вид сбоку слева; h — уросома, вид сбоку справа; i — генитальный членик, вид с брюшной стороны.

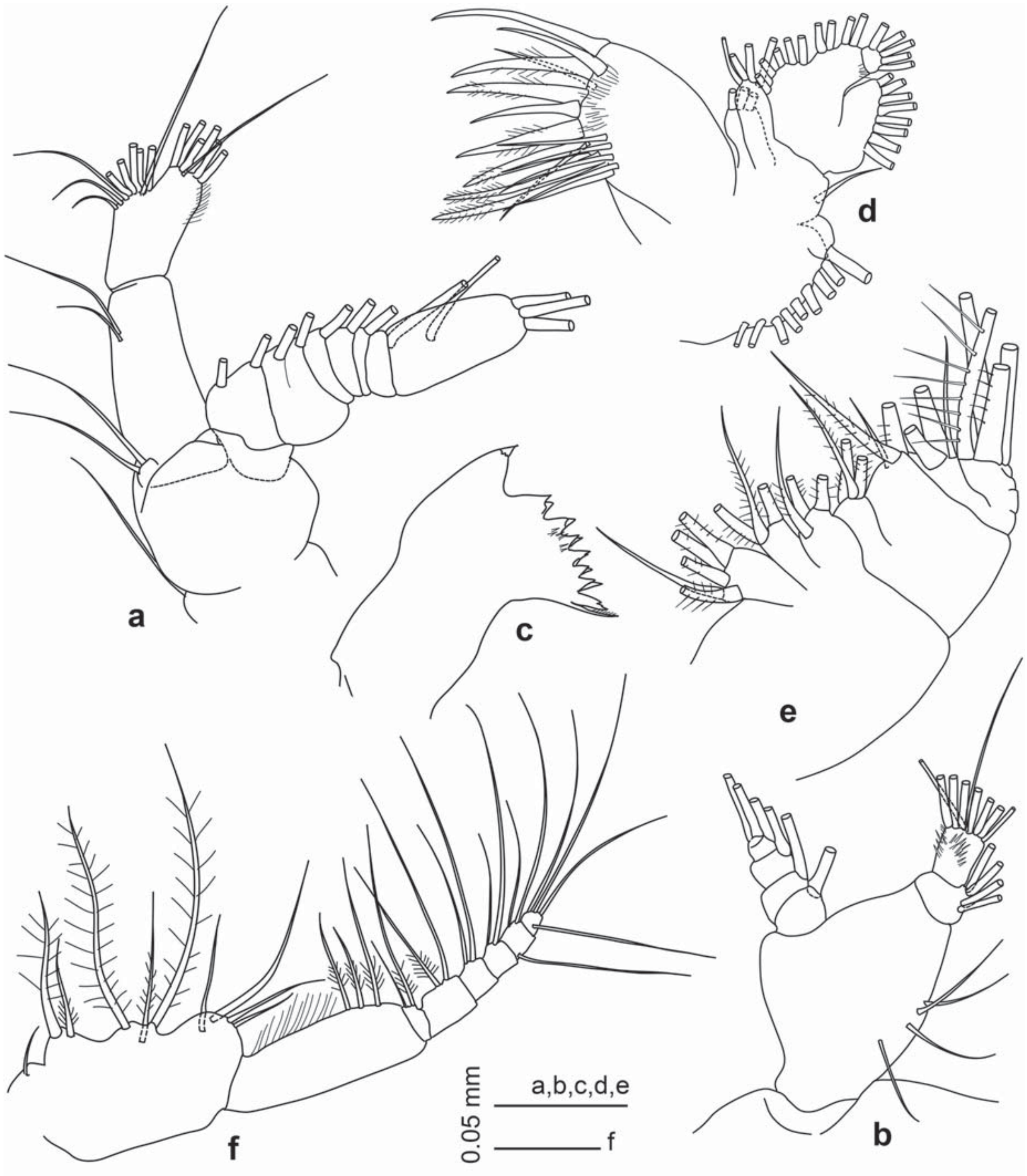


Fig. 2. *Centropages ponticus* female: a — antenna; b — mandibular palp; c — mandible gnatobase; d — maxillule; e — maxilla; f — maxilliped.

Рис. 2. *Centropages ponticus*, самка: a — антенна; b — щупик мандибулы; c — жевательный край мандибулы; d — максиллула; e — максилла; f — максиллипеда.

Maxillule (Fig. 2d): praecoxal arthrite with 15 (9 terminal, 4 posterior and 2 anterior) spines and with fine long setules at the base of the spines; coxal endite with three setae and coxal epipodite with nine setae; basal endites 1 and 2 with four and five setae, respectively; basal exite with one seta; endopod with four lateral and five apical setae, exopod with eight setae.

Maxilla (Fig. 2e) with long, strong and spinous setae: praecoxal endites 1 and 2 with five and three setae, respectively; endites 3 and 4 on coxa with three setae each; basal endite with three setae; endopod with seven setae.

Maxilliped (Fig. 2f): syncoxa with 1, 2, 3, 4 setae; basis with three setae; endopod segment 1 with two

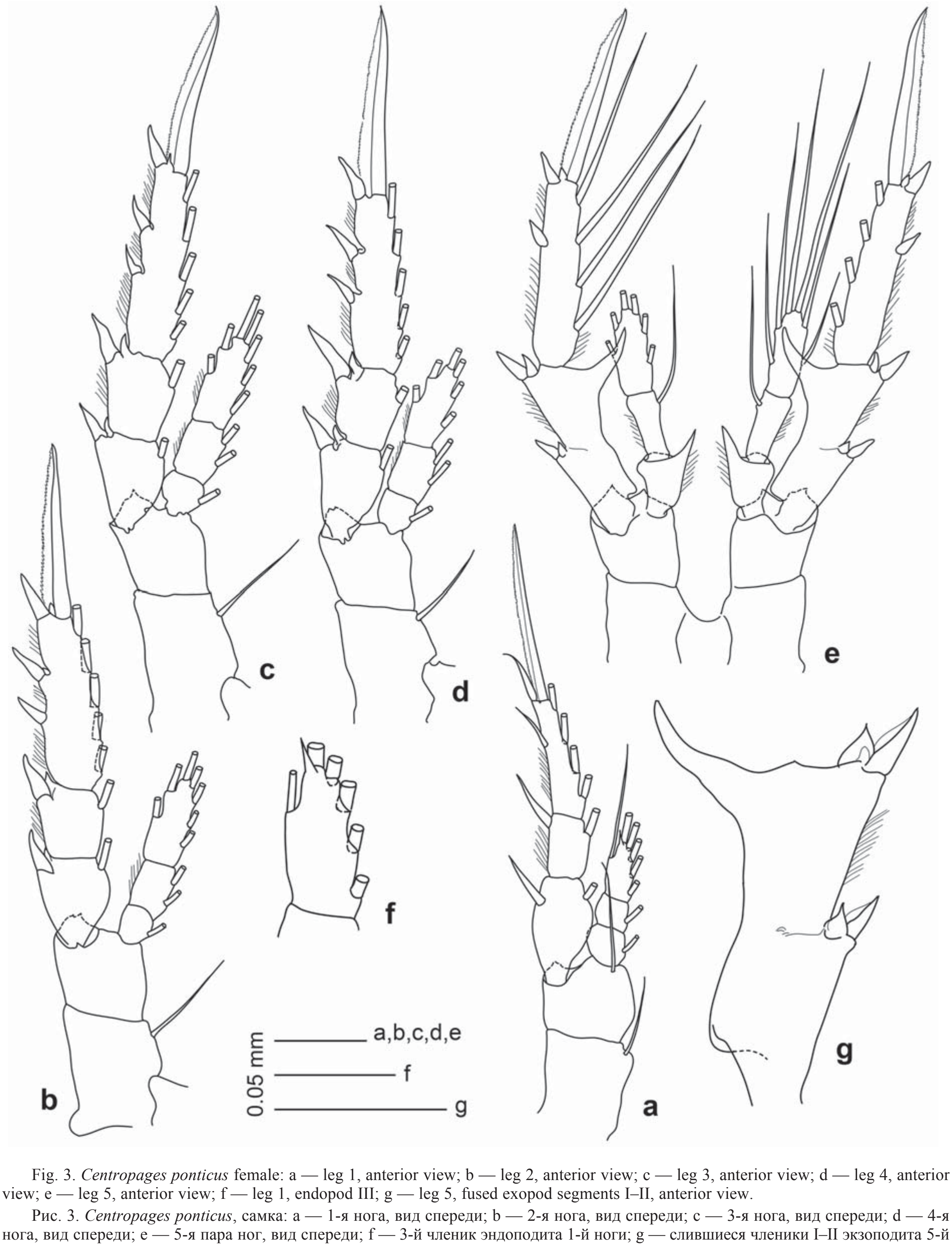


Fig. 3. *Centropages ponticus* female: a — leg 1, anterior view; b — leg 2, anterior view; c — leg 3, anterior view; d — leg 4, anterior view; e — leg 5, anterior view; f — leg 1, endopod III; g — leg 5, fused exopod segments I–II, anterior view.

Рис. 3. *Centropages ponticus*, самка: а — 1-я нога, вид спереди; b — 2-я нога, вид спереди; c — 3-я нога, вид спереди; d — 4-я нога, вид спереди; e — 5-я пара ног, вид спереди; f — 3-й членик эндоподита 1-й ноги; g — слившиеся членики I–II экзоподита 5-й ноги, вид спереди.

setae; endopod segments 2–6 with 2, 2, 2, 2 + 1, 3 + 1 setae, respectively.

Legs 1–4 (Figs 3a–d, 7c,d) biramous, with three-segmented endopods and three-segmented exopods. Spine and seta formulae as in Table 1 (spines are designated by Roman numerals; setae are designated by Arabic numerals). Number of outer spines in exopod 3 and inner setae in endopod 3 of legs 2–4 variable

Table 1. Spine and seta formulae of swimming legs 1–5 in *Centropages ponticus*.
Таблица 1. Формулы шипов и щетинок плавательных ног 1–5 у *Centropages ponticus*.

Leg	Coxa	Basis	Exopod	Endopod
P1	0–1	0–1	I–1; I–1; II, I, 4	0–1; 0–1; 1, 2, 3
P2	0–1	0–0	I–1; I–1; III/II, I, 5	0–1; 0–2; 2, 2, 3
P3	0–1	0–0	I–1; I–1; III/II, I, 5	0–1; 0–2; 2, 2, 3
P4	0–1	0–0	I–1; I–1; III/II, I, 5	0–1; 0–2; 2, 2, 2/3
P5 ♀	0–0	0–0	II–0; II, I, 4	0–0; 0–1; 2, 2, 2
P5 ♂ left	0–0	0–0	I–0; II, I, 0	0–1; 0–1; 2, 2, 2
P5 ♂ right	0–0	0–0	I–0; I–0; I–I	0–1; 0–1; 2, 2, 2

Table 2. Variability of spines and setae number in swimming legs 2–4 in *Centropages ponticus*.
Таблица 2. Изменчивость количества шипов и щетинок плавательных ног 2–4 у *Centropages ponticus*.

		Female (n=68, right and left rami from 34 specimens)			Male (n=62, right and left rami from 31 specimens)		
		P2	P3	P4	P2	P3	P4
		occurrence, %			occurrence, %		
Number of outer spines in ExpIII	2	53.0	16.2	10.3	77.4	6.5	6.5
	3	47.0	83.8	89.7	22.6	93.5	93.5
Number of inner setae in EnpIII	2			94.1			98.4
	3	98.5	100.0	5.9	100.0	100.0	1.6
	4	1.5					

(Table 2). Variability manifests whether in both left and right rami simultaneously or in one ramus only (Fig. 7c). Leg 1 endopod segment 3 distal corner pointed (Fig. 3f).

Leg 5 (Fig. 3e) biramous, symmetrical. Exopod ancestral segments I and II fused, fusion line is faintly visible on anterior surface only and absent in posterior surface (Fig. 7e,f), inner distal corner transformed into strong thick and curved projection (Fig. 3g); endopod three-segmented, segment 1 inner distal corner with large triangular extension reaching the midlenght of endopod segment 2. Spine and seta formula as in Table 1.

Male. Total length 0.92–1.08 mm (mean 1.01 mm, n = 32). Body slightly slender than in female, prosome about 2.3 times as long as urosome. Cephalosome and first pedigerous somite, fourth and fifth pedigerous somites separate, the latter with two caudally produced, symmetrical or slightly asymmetrical, with the left one slightly bigger, pointed projections (Fig. 4e,f). Rostrum extends into two thin, ventroposteriorly directed filaments. Urosome of five free somites, genital somite shorter than urosomite II, genital opening on the left side, urosomite V very small. Caudal rami symmetrical, slightly dilated posteriorly, with six terminal setae and small setules in the inner border; ancestral seta I absent, seta VII inserted immediately anterior to seta VI; seta V longest being approximately as long as urosome including caudal rami, seta VII shortest (Fig. 4a,e).

Left antennule (Fig. 4c) as in female. Right antennule (Fig. 4d,g) geniculated, of 21 free segments, with main geniculation between segments XX and XXI, ancestral segments II–IV, XXI–XXIII, XXIV–XXV fused; armature as follows: I–2s + 1a, II-IV–3s + 1a, V–1s + 1a, VI–2s+ 1a, VII–2s+ 1a, VIII–1s + 1a, IX–2s+ 1a, X–2s + 1a (distalmost seta modified – shortened and sharply pointed), XI to XVIII–2s + 1a, XIX–1s + 1a, XX–1s + 1a, XXI–XXIII–1s + 1a, XXIV–XXV–2s + 2s, XXVI–XXVIII–5s + 1a. In segments XII, XIII, XIV, distalmost seta short, in the shape of a spike; segments XVII and XVIII with a lamelliform crest at anterior margin each; segment XIX with a toothed ridge at the proximal anterior margin extending beyond the anterior part of segment XX; segment XX with a smaller, as compared to that of segment XIX, toothed ridge at the proximal anterior margin not reaching the segment's distal end; compound segments XXI–XXIII with a toothed ridge at the proximal anterior margin ending in a pointed and slightly curved lamella at approximately mid-length of the segment (Fig. 4g).

Antenna, mandible, maxillule, maxilla, maxilliped (Fig. 5a–e) well-developed, with segmentation and setal formulae as in female.

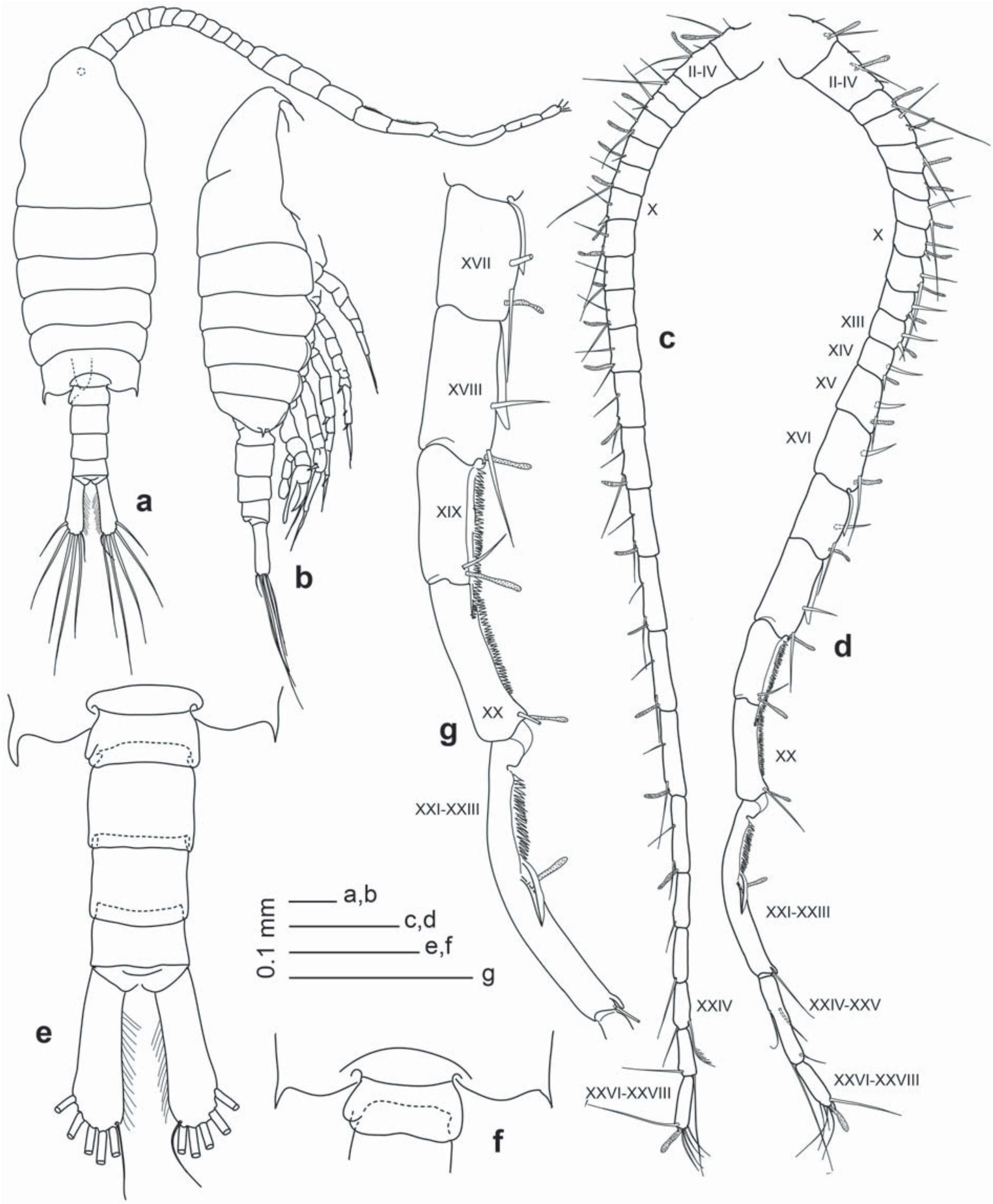


Fig. 4. *Centropages ponticus* male: a — dorsal view; b — lateral view; c — left antennule; d — right antennule; e — posterolateral corners of 5th pedigerous somite and urosome, dorsal view; f — posterolateral corners of 5th pedigerous somite, a variant, dorsal view; g — right antennule, segments XVII–XXIII.

Рис. 4. *Centropages ponticus*, самец: a — вид со спинной стороны; b — вид сбоку; c — левая антеннула; d — правая антеннула; e — заднелатеральные выступы 5-го торакального членика и уросома, вид со спинной стороны; f — заднелатеральные выступы 5-го торакального членика, вариант, вид со спинной стороны; g — членики XVII–XXIII правой антеннулы.

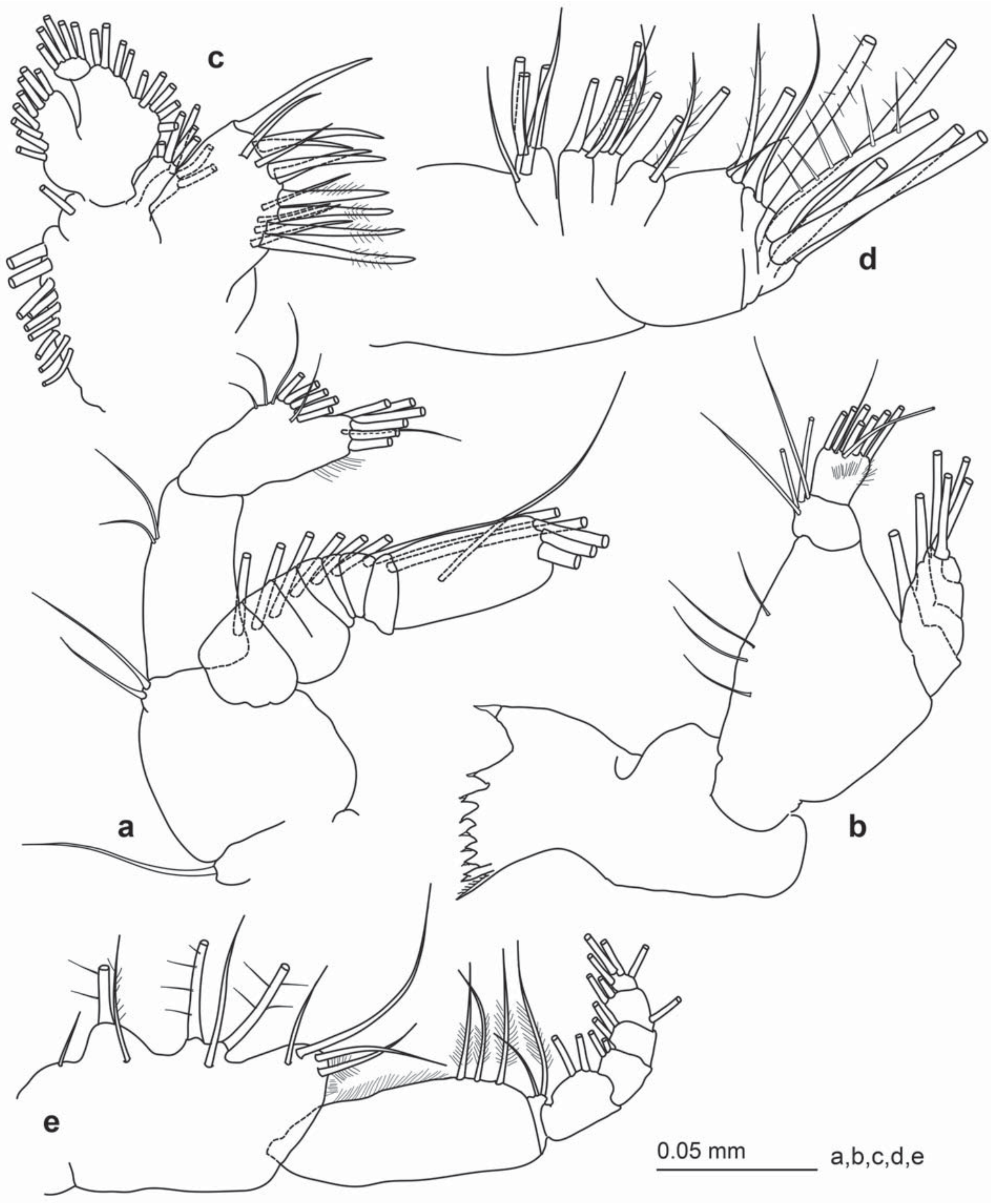


Fig. 5. *Centropages ponticus* male: a — antenna; b — mandible; c — maxillule; d — maxilla; e — maxilliped.
Рис. 5. *Centropages ponticus*, самец: a — антенна; b — мандибула; c — максиллула; d — максилла; e — максиллипеда.

Swimming legs 1–4 (Fig. 6a–d) with segmentation and armature as in female (Table 1), including changeability of the number of outer spines in exopod 3 and inner setae in endopod 3 in legs 2–4. Leg 4 slightly asymmetrical, with outer spine on right exopod 2 approximately twice longer and directed more laterally than that on left exopod 2.

Leg 5 (Fig. 6 e,f, h,i) biramous, asymmetrical, modified. Left leg: exopod two-segmented with ancestral segments I and II fused, terminal segment with a small

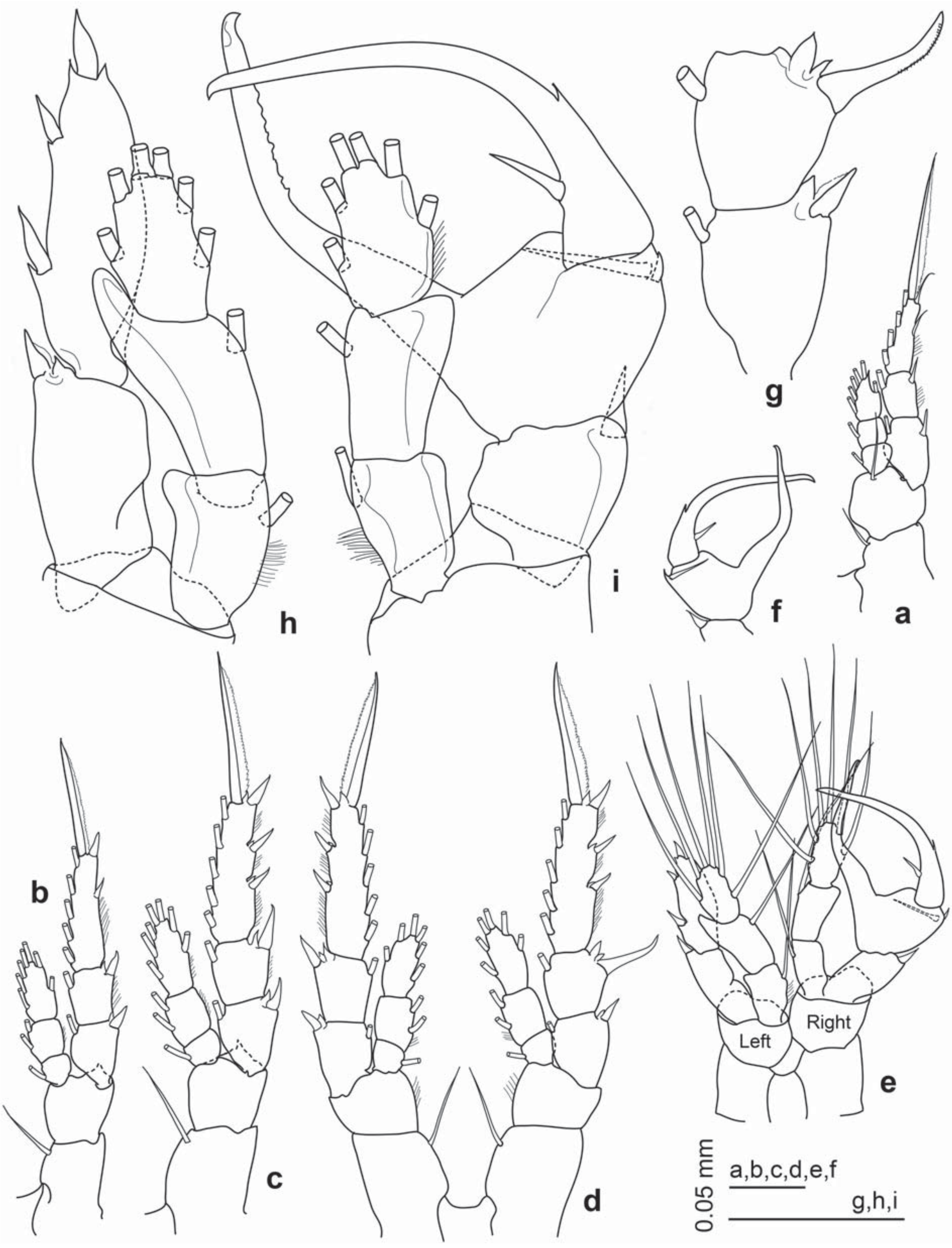


Fig. 6. *Centropages ponticus* male: a — leg 1, anterior view; b. leg 2, anterior view; c — leg 3, anterior view; d — leg 4, anterior view; e — leg 5, anterior view; f — right leg 5, exopod segments II–III, posterior view; g — leg 4 right exopod segments I–II; h — leg 5, left ramus, anterior view; i — leg 5, right ramus, anterior view.

Рис. 6. *Centropages ponticus*, самец: a — 1-я нога, вид спереди; b — 2-я нога, вид спереди; c — 3-я нога, вид спереди; d — 4-я пара ног, вид спереди; e — 5-я пара ног, вид спереди; f — членики II–III правого экзоподита 5-й ноги, вид сзади; g — членики I–II правого экзоподита 4-й ноги; h — левая ветвь 5-й ноги, вид спереди; i — правая ветвь 5-й ноги, вид спереди.

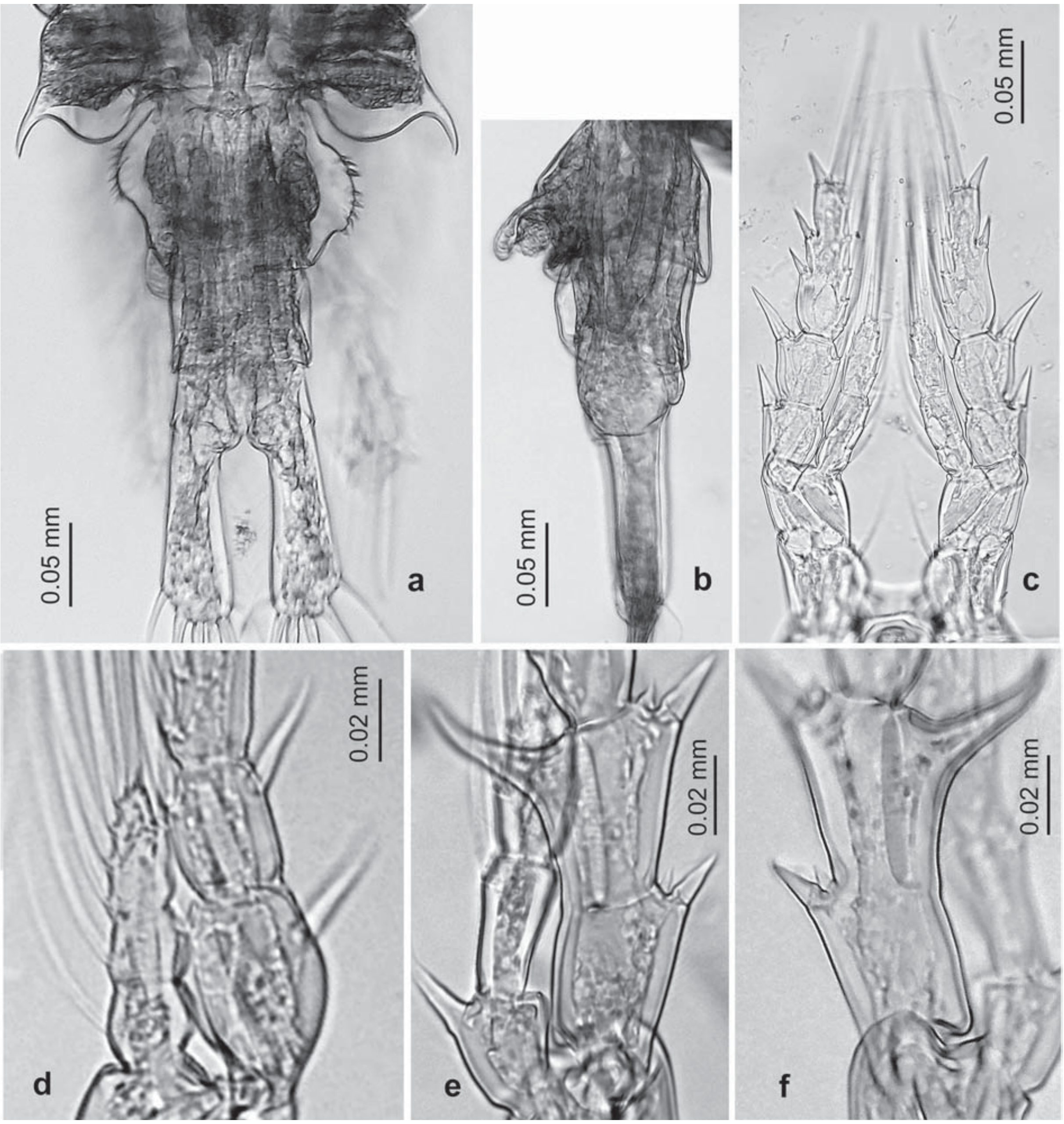


Fig 7. *Centropages ponticus* female: a — urosome and fifth pedigerous somite, dorsal view; b — urosome, left lateral view; c — leg 2 demonstrating variability of outer spines in exopod 3; d — leg 1 endopod demonstrating presence of only one seta in the second segment; e — leg 5, fused exopod segments I–II, anterior surface, with fusion line faintly visible; f — leg 5, fused exopod segments I–II, posterior surface, fusion line absent.

Рис. 7. *Centropages ponticus*, самка: a — уросома и 5-й торакальный членик, вид со спинной стороны; b — уросома, вид сбоку слева; c — 2-я пара ног, демонстрирующая вариабельность количества наружных шипов на 3-м членике экзоподита; d — эндоподит 1-й ноги, демонстрирующий наличие только одной щетинки на 2-м членике; e — слившиеся членики I–II экзоподита 5-й ноги, передняя поверхность, линия слияния едва заметна; f — слившиеся членики I–II экзоподита 5-й ноги, задняя поверхность, линия слияния отсутствует.

terminal spine; endopod three-segmented, segment 1 outer distal corner with a small swelling; segment 2 outer distal corner with a large swelling. Right leg: exopod three-segmented, with two terminal segments forming a chela: segment 2 inner distal corner modified into a claw-like extension, outer distal corner with thin and relatively long spine directed posteriorly; segment 3 elongated and curved, with a medium-sized inner spine and very small outer spine.

Table 3. Key characters for distinguishing between the species of the *hamatus* group of the genus *Centropages*.
Таблица 3. Ключевые признаки для различения видов группы *hamatus* рода *Centropages*.

Character	*C. abdominalis*	*C. hamatus*	*C. kroyeri*	*C. ponticus*	*C. tenuiremis*
FEMALE					
Projections of the last thoracic somite	directed postero-aterally; do not reach midlength of Gns	directed postero-aterally; do not reach midlength of Gns	directed postero-aterally; do not reach midlength of Gns	directed postero-aterally; do not reach midlength of Gns	directed posteriorly, extending beyond posterior border of Gns
Leg 5:	symmetrical	symmetrical	symmetrical	symmetrical	asymmetrical
Leg 5 Exp I–II	separate	separate	separate	fused in both left and right rami with fusion line partly visible on anterior side	fused in right ramus with fusion line partly visible on anterior side; separate in left ramus
Leg 5 Exp II inner projection	medium-sized, extends to midlength of Exp III	medium-sized, does not reach midlength of Exp III	medium-sized, does not reach midlength of Exp III	medium-sized, does not reach midlength of Exp III	right ramus: large and swollen at its base; left ramus: medium-sized, not swollen at its base
Leg 5 Enp I inner distal corner	without extension	without extension	with large triangular extension	with large triangular extension	without extension
MALE					
Leg 4 right Exp II outer distal spine	nearly same size and direction as in left Exp II	bigger and directed more laterally than that on left Exp II	bigger and directed more laterally than that on left Exp II	directed more laterally and about 2.5 times as long as that on left Exp II	directed posteriorly, pubescent, and about 2.5 times as long as that on left Exp II
Leg 4 right Exp III lateral spine 3	about 0.5 times as long as terminal spine	about 0.3 times as long as terminal spine	n/d	less than 0.3 times as long as terminal spine	less than 0.3 times as long as terminal spine
Leg 5 right Exp II claw-like extension	shorter as compared with Exp III	shorter as compared with Exp III	longer as compared with Exp III	shorter as compared with Exp III	shorter as compared with Exp III
Leg 5 left Enp II outer distal corner	with small swelling	without swelling	with small swelling	with large swelling	without swelling
Sources	Hirakawa, 1986; Mori, 1937; Shen, Bai, 1956	Lee, 1972; Sars, 1902	Giesbrecht, 1893; Kovalev, 1967	Present study, the Black Sea specimens	Original data, the Arabian Sea specimens

Discussion

Comparison of species within the *hamatus* group

Vervoort [1964] pointed out the genus *Centropages* to be "badly in need of a thorough taxonomical revision", and arranged known to that time *Centropages* species provisionally into five species groups: *typicus*, *furcatus*, *hamatus*, *orsinii*, and *violaceus*, with *C. ponticus* referred to the *hamatus* group along with *C. abdominalis* Sato, 1913; *C. alcocki* Sewell, 1912; *C. hamatus* (Lilljeborg, 1853); *C. kroyeri* Giesbrecht, 1893; *C. tenuiremis* Thompson et Scott, 1903; and *C. trispinosus* Sewell, 1914. Subsequently, Ohtsuka *et al*. [2003, 2005] recognized two other groups: *trispinosus* and *alcocki*, thereby removing two corresponding species from the Vervoort's *hamatus* group. Thus, to date, the *hamatus* group includes five species (Table 3). *C. ponticus* can be distinguished from the other species of the *hamatus* group by details of morphology of fifth legs, namely: (i) by having exopod segments I–II fused in both right and left rami in female, and (ii) by having a large swelling on outer distal corner of the left endopod segment II in male. Additionally, from its closest congener, *C. kroyeri*, *C. ponticus* is distinguished by relative length of the male fifth leg right exopod segment II claw-like extension: in *C. ponticus* this element is shorter as compared to exopod segment 3, whereas in *C. kroyeri* this element is longer as compared to exopod segment 3.

Morphological variability within *C. ponticus*

The present study has revealed the occurrence of variability in number of outer spines in exopod 3 of legs 2–4 (two or three spines) in *C. ponticus* in the Black Sea. Karavaev [1895] also noted that some specimens of *C. ponticus* in his collection had two outer spines in the second leg exopod segment III, considering the segment bearing three spines to be "the norm",

Table 4. Main morphological differences between the specimens of *Centropages ponticus* from the Black and Mediterranean seas.
Таблица 4. Основные морфологические различия между экземплярами *Centropages ponticus* из Черного и Средиземного морей.

Region	Sevastopol Bay, Black Sea, present study	Cullera Bay, western Mediterranean [Soler *et al*., 1988]	Saline Lake Mir, Adriatic Sea [Kršinić, 2017]
Season of sampling	August 2013	August *	November 1999 – October 2000
FEMALE			
Total length, mm	1.07–1.22 (mean 1.15)	0.77–0.97 (mean 0.84)	0.74–0.82 (mean 0.79)
Th5 postero-lateral projections	symmetrical	asymmetrical, right projection bigger	n/d
Pr/Ur ratio	~2.5	2.27	n/d
Gns width/height ratio	~1.4	~1.0	~1.2
Spinules on middorsal surface of Gns	absent	present	present
Gns dorsal surface	flat when viewed laterally	convex when viewed laterally	n/d
Number of inner setae in P1 EnpII	1	2	n/d
P5 ExpI-II fusion line	faintly visible on anterior surface only	"not always visible"	absent
P5 EnpI internal corner	with large triangular extension	without extension, with a thick and relatively short seta	with a spine-like extension
MALE			
Total length, mm	0.92–1.08 (mean 1.01)	0.66–0.84 (mean 0.76)	0.68–0.80 (mean 0.76)
Number of inner setae in P1 EnpII	1	2	n/d

* The year of sampling is not indicated in Soler *et al*., 1988.

and explaining the variants with two spines by an immature condition of the specimens. Perhaps Karavaev's opinion that three spines are "the norm" was based on the work of Giesbrecht [1893], in which ten different representatives of the genus *Centropages* were described as having three spines in exopod 3 of legs 2–4. We confirm that specimens with reduced amount of spines and setae in swimming legs in our study were mature females and males. The fact that this kind of variability in *C. ponticus* was recorded earlier, more than 100 years ago [Karavaev, 1895], allows us to conclude that the revealed in the present study variability is one of the morphological characteristics of *C. ponticus* in the Black Sea.

Comparison of the results obtained during the present study with literature data describing *C. ponticus* from the Cullera Bay, western Mediterranean [Soler *et al*., 1988], and Lake Mir, Adriatic Sea [Kršinić, 2017] has shown that the main morphological features characterizing this species and distinguishing it from its closest congeners (namely, fused exopod segments I–II in leg 5 in female, and details and proportions of leg 5 in male) are similar for the specimens under comparison. However, specimens of *C. ponticus* in each of these three areas have their own distinguishing features, and the Black Sea individuals differ in some morphological details from those of the Mediterranean Sea (Table 4). The most notable differences are in: (i) the total length of both females and males (the Black Sea specimens are about 1.3–1.4 times as long as the Mediterranean Sea ones), (ii) the shape and ornamentation of the genital double-somite (in the Black Sea specimens, dorsal surface of the somite flat, without spinules, whereas in the Mediterranean Sea ones, dorsal surface of the somite convex, with spinules), (iii) the number of setae in the leg 1 endopod segment II (*C. ponticus* from the Black Sea has one seta in leg 1 endopod segment II whereas specimens from the Cullera Bay have two setae in this segment), (iv) the shape of the female leg 5 endopod segment I internal corner (with large triangular extension in specimens from the Black Sea and Lake Mir, and with no extension in specimens from the Cullera Bay) (Table 4). In the referenced works [Kršinić, 2017; Soler *et al*., 1988], there are no indications regarding occurrence of variability of the number of outer spines and setae in swimming legs 2–4 in *C. ponticus* from the Cullera Bay and Lake Mir. The absence of such the indications can both confirm the fact that the Mediterranean specimens of *C. ponticus* do not have this kind of variability, as well as be a consequence of insufficient attention of researchers to these details.

Further investigations of *C. ponticus* in the Mediterranean Sea, including molecular analysis, are needed to obtain accurate information on the intraspecific variability as well as on the degree of relatedness of populations of this species from different regions of the Mediterranean basin.

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